



*Independent Statistics & Analysis*

U.S. Energy Information  
Administration

# The Distribution of U.S. Oil and Natural Gas Wells by Production Rate

January 2022



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## Introduction

Technological innovation in drilling and production has recently caused rapid growth in U.S. oil and natural gas production. Exploring how U.S. oil and natural gas wells have changed provides deeper insight into this rapid growth. In this report, we present data on the distribution of wells by size and technology and analyze emerging trends.

U.S. oil production, which includes crude oil and condensate, reached 12.9 million barrels per day (b/d) in December 2019, and U.S. natural gas gross withdrawals reached 116.9 billion cubic feet per day (Bcf/d) in December 2019. U.S. oil production and natural gas gross withdrawals both declined in 2020 and averaged 11.1 million b/d and 113.1 Bcf/d in December 2020, respectively.<sup>1</sup> [U.S. crude oil and natural gas production declined in 2020](#) because of lower demand linked to the COVID-19 pandemic.

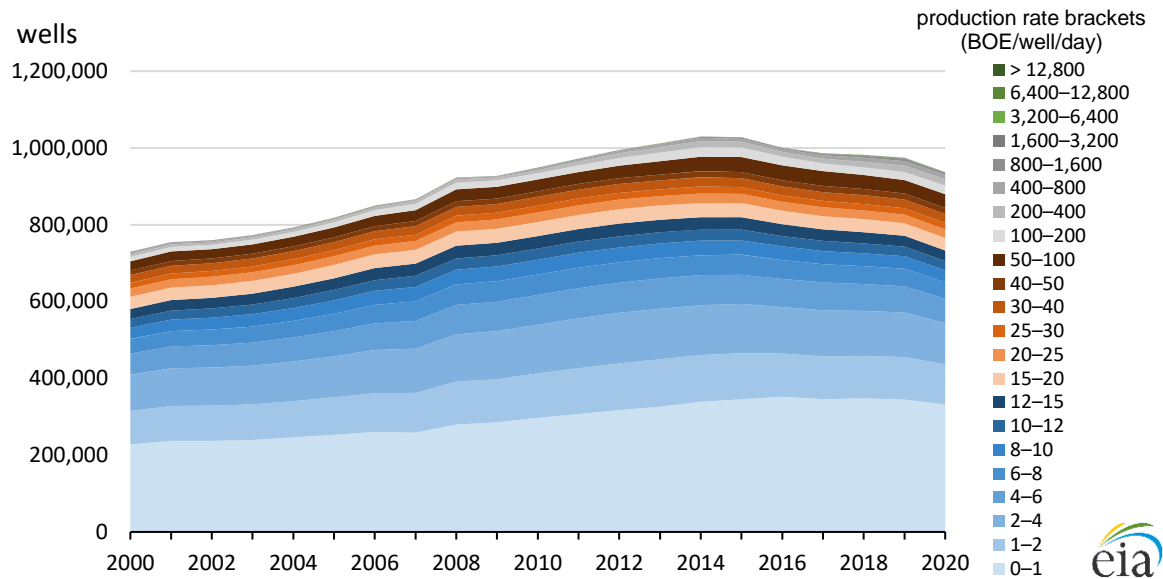
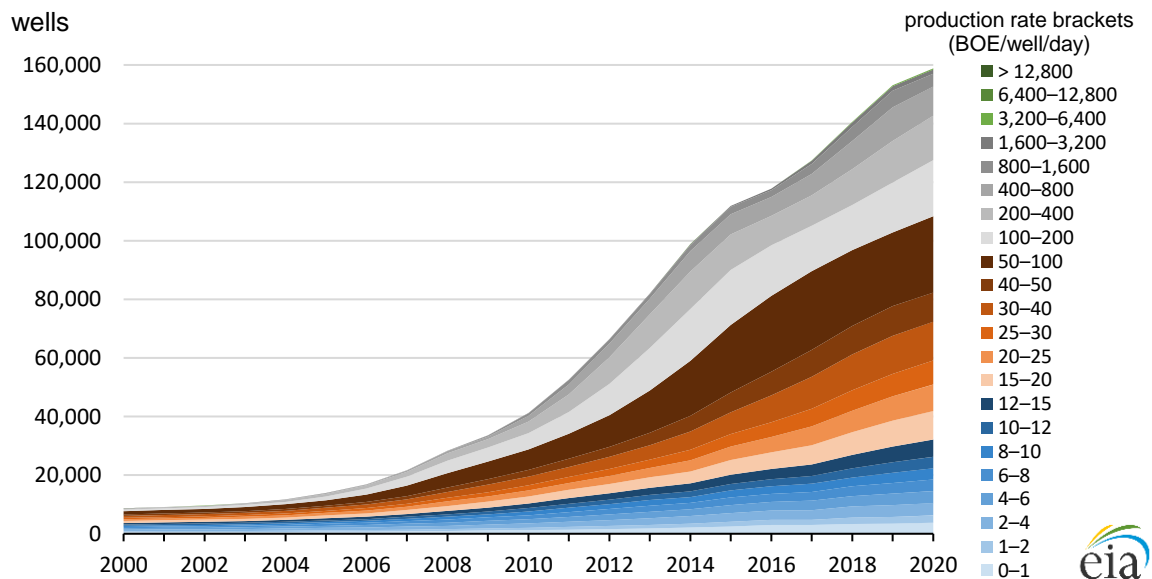
The number of producing wells in the United States reached a high of 1,029,588 wells in 2014 and steadily declined to 936,934 wells in 2020—mostly because of lower oil prices and [less rig activity](#) (Figure 1). The increase in the share of horizontal wells during the past decade from 4.4% to 16.9% (2010–20) shows the impact of technological change on well type (Figure 2). More than half of U.S. oil and natural gas production comes from wells that produce between 100 barrels of oil equivalent per day (BOE/d) and 3,200 BOE/d (Figures 3 and 4, respectively). The share of U.S. oil and natural gas wells producing less than 15 BOE/d has remained steady at about 80% from 2000 through 2020 (Figure 1).

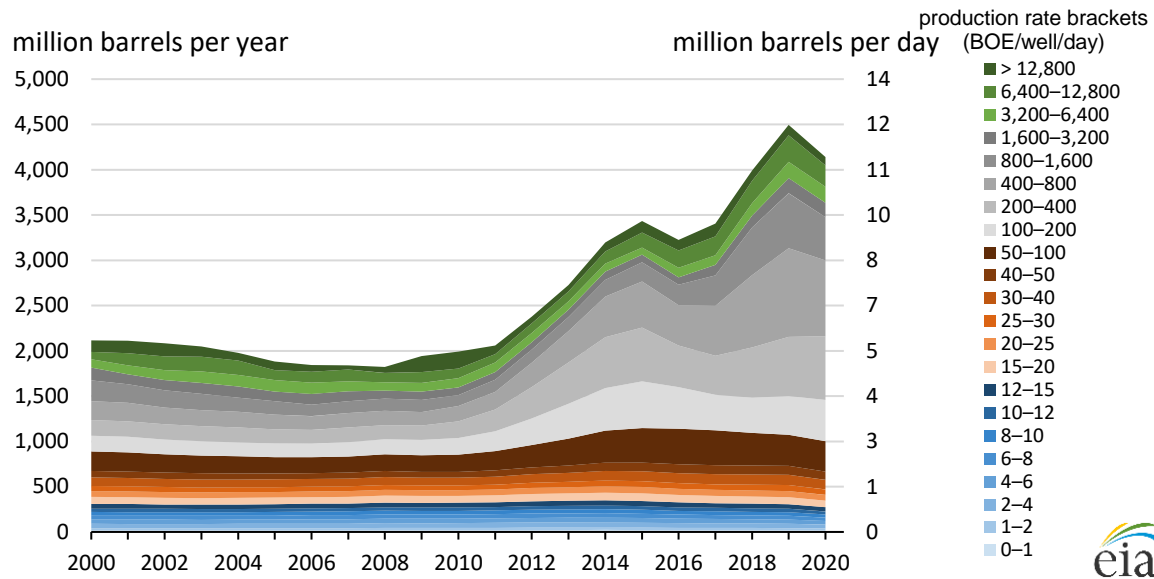
This report provides yearly estimates of producing oil and natural gas wells in the United States, which are grouped according to volume in 1 of 22 production volume brackets that range from less than 1 BOE/d to more than 12,800 BOE/d. We designate wells as either oil or natural gas wells based on a gas-oil ratio (GOR) of 6,000 cubic feet of natural gas to 1 cubic foot per barrel (cf/b) of oil for each year's production. If the GOR is equal to or less than 6,000 cf/b, then we classify the well as an oil well. If the GOR is greater than 6,000 cf/b, we classify the well as a natural gas well.

The distribution tables for the production rates of all U.S. oil and natural gas wells include 2000 through 2020. Appendix B provides summary breakouts for the total United States, each state, the Federal Offshore Gulf of Mexico, and the Federal Offshore Pacific. You can use the Appendix C spreadsheet to generate figures for all regions and for additional variables.

The quality and completeness of the available data we used to build the tables varies by state. The data originate from state administrative records of monthly well- or lease-level natural gas and liquid production. We receive the data from the commercial source [Enverus](#), which collects the data from the various state agencies. Some state agencies do not make well-production data available until years after production occurs, and others have never made well-production data available. For the late-reporting states—Kentucky, Maryland, Missouri, and Tennessee—we use the last year of reported data to populate recent missing years to achieve the most complete U.S. total well counts. Data are not available for Illinois and Indiana. Appendix A shows the reporting status for each state and year covered in the report and the availability of completion, well, and lease data by state.

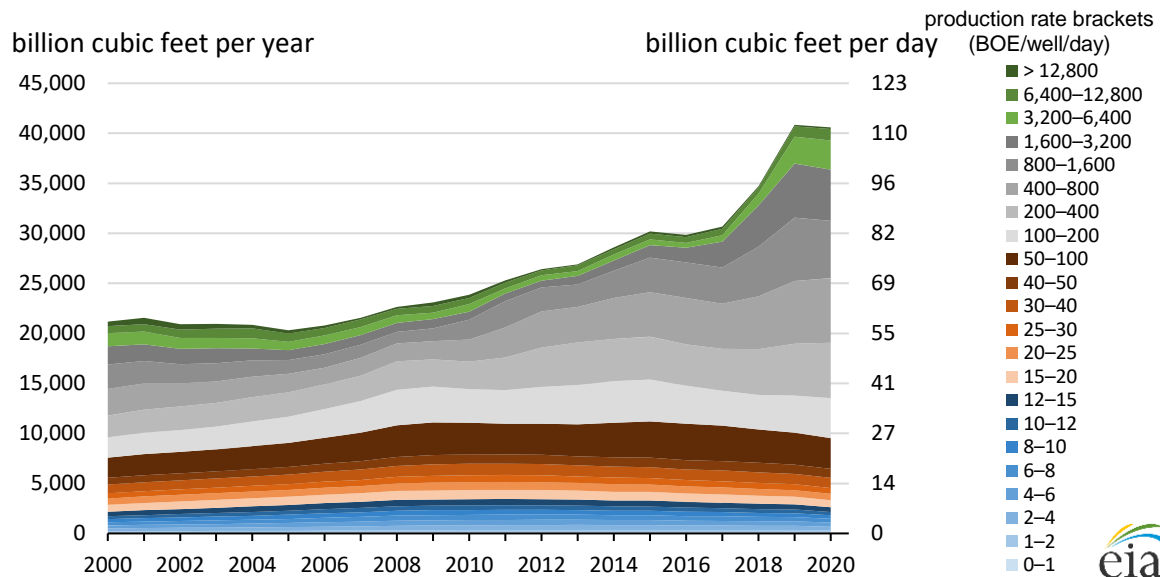
<sup>1</sup> Source: U.S. Energy Information Administration, [Monthly Crude Oil and Natural Gas Production](#), August 31, 2021.

**Figure 1. U.S. total wells by production rate brackets****Figure 2. U.S. total horizontal wells by production rate brackets**

**Figure 3. Oil production from U.S. wells by production rate brackets**

Source: Graph by the U.S. Energy Information Administration, based on data from Enverus

Note: BOE=barrel of oil equivalent

**Figure 4. Natural gas production from U.S. wells by production rate brackets**

Source: Graph by the U.S. Energy Information Administration, based on data from Enverus

Note: BOE=barrel of oil equivalent

## Definition of a Well

### How we define wells

This report and the tables include the following types of wells:

- Single wellhead
- Sidetrack
- Completion
- Recompletion
- Lease

We included every producing *entity* in the Enverus database in this report. When we know the number of wells on a lease, we distribute the total lease production equally among the wells; however, in some cases, the commercial source has allocated individual well production in proportion to well test results. Sometimes, only a lease and its total production are available (without the well counts), which leads to undercounted wells in some areas.

### Production volume accounting

We removed identified reinjected and recycled natural gas from the gross natural gas volumes reported by states, such as Alaska. For fields identified as having undergone or as currently undergoing natural gas injection, we reduced production levels by an equal share of the field-level injected natural gas the states reported. We did not include injection wells in the counts unless they were producing wells at one time; in such cases, we included those wells for the years they were producing.

The pressure base that producers use to record natural gas volumes varies by state. For consistency, we converted all natural gas volumes to the federal pressure base of 14.73 pounds per square inch absolute (psia). However, we did not make adjustments to account for differences in the temperature base; instead, we assumed states used 60°F as the temperature base. Because states vary in how they define a well type (oil or natural gas), we used a GOR of greater than 6,000 cf/b to designate a well as a natural gas well. We designated wells with less than or equal to 6,000 cf/b as oil wells.

We excluded storage wells, dry holes, and wells that produce exclusively within CO<sub>2</sub> fields.

### Consistency with other data sources

The total volumes shown in the distribution tables represent a snapshot of available data at the time we assembled the report and may not exactly equal other related data, including other EIA sources.

Differences sometimes exist in:

- The timing of updates from state and commercial sources
- The availability of state-level aggregate production data versus well-level data
- The definition of a *well* and which *entities* we counted and summed

For example, we publish EIA's official oil and natural gas production volumes in the [Petroleum Supply Annual 2020](#) DOE/EIA-0340(19) and [Natural Gas Annual 2020](#), DOE/EIA-0131(19), which we base on the Form EIA-914, *Monthly Production Report*. We based the production numbers in the tables and figures of this report on data reported in [Enverus](#).

## Methodology

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### How we analyzed and aggregated the data

First, we used the number of days of production activity to convert volumes to a daily rate for the BOE-rate classes in the tables. For this calculation, we did not use the reported *days on* production measure for a well because it is often not available in the database. Instead, we used calendar days for consistency. To calculate the months in production, we determined the monthly production data for the first month and first year of production and the last month and last year of production for each well. We counted days of production using the number of calendar days in each month for the first year and last year of production. For the middle years of production, we used full years of 365 (or 366) days for days of production.

Next, we added the monthly oil and natural gas volumes, along with the number of days of production, to determine annual totals for each well. We converted the annual natural gas volume to BOE using the GOR of 6,000 cf/b. We classified the well as an oil well if its production of barrels of oil was greater than the natural gas production converted to BOE, and we classified it as a natural gas well if its BOE production was greater than the oil production. We then added the natural gas BOE to the liquid value for a total BOE for each year of the well's production. We divided this total BOE by the number of calendar days the well was in production status, often a partial year for the first and last years and a full year for middle years. Each year of a well's production appears in the appropriate BOE rate class in the tables.

Finally, we added the well counts and production levels for each rate class to produce the yearly state tables for the report.

## Frequently Asked Questions

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### What is the average production rate of a well, and how does this rate differ between oil wells and natural gas wells?

In 2020, the average oil well produced 26.3 b/d of oil (33.9 BOE/d of total oil and natural gas), and the average natural gas well produced about 192,500 cf/d of natural gas (35.5 BOE/d of total oil and natural gas). However, the distribution by well size is generally skewed. Many wells produce smaller volumes per day, and fewer wells produce very large volumes per day. In 2020, about 78% of the more than 936,000 U.S. wells produced less than 15 BOE/d, and about 6% of the wells produced more than 100 BOE/d.

### What are some of the key conclusions from our data?

Although the total number of operating U.S. oil and natural gas wells has decreased about 9% from a peak in 2014—from more than 1,029,000 wells to about 936,000 wells in 2020—the total number of horizontally drilled wells has increased 61% from slightly less than 99,000 wells to about 159,000 wells in 2020. Oil and natural gas wells drilled horizontally through hydrocarbon-bearing formations are among the most productive wells in the United States.



We published several *Today in Energy* articles on this topic based on earlier versions of the data, such as the following:

- [U.S. crude oil and natural gas production increased in 2018, with 10% fewer wells](#), February 3, 2020
- [Horizontally drilled wells dominate U.S. tight formation production](#), June 6, 2019
- [U.S. crude oil and natural gas production increased in 2017 with fewer wells](#), November 14, 2018
- [Oil wells drilled horizontally are among the highest-producing wells](#), November 4, 2016

## What is the source of our data, and how do we collect it?

Our data source is Enverus. We receive a monthly download from Enverus containing the most recent production information. This commercial data source collects the data from the various state agencies involved in regulating oil and natural gas production.

## How often do we collect well-production data for the Lower 48 states?

Some states make data available within a few months after a new well begins production, and other states may take more than 18 months to release that data. The average lag between a new well's first production and reported production in the database is six to eight months.

In addition, states sometimes revise historical data because they continue collecting and digitizing older well datasets to include in their databases. States may also revise data if they identify inaccuracies.

## How often will we update this report?

We plan to update this report each year by November or December when complete or nearly complete data for the previous year are available for most states.

## How does counting only wellheads compare with the counts in this report, which also include sidetracks, completions, and recompletions?

Our estimates of U.S. wellhead counts (for example, the [number of producing natural gas wells reported in our \*Natural Gas Annual\*](#)) for 2020 are 9% lower than the counts in this report. This difference results from how we categorize natural gas wells or wells in late-reporting states (Kentucky, Maryland, Missouri, and Tennessee) and wells in non-reporting states (Illinois and Indiana).

## Does a natural gas well remain a natural gas well during its entire production history?

In this report, we sometimes classify a well as a natural gas well in one year and as an oil well in another year, and vice versa, depending on a well's GOR. We use this approach because the respective volumes of liquid and natural gas produced by a well can change significantly during the well's production history.

## Do we distinguish between associated natural gas and nonassociated natural gas?

The report distinguishes between associated and nonassociated natural gas based on whether we classify the well as an oil well or a natural gas well. If we classify the well as a natural gas well, then we consider the natural gas as nonassociated gas and the liquid as condensate, which is counted as oil. If we classify the well as an oil well, then we consider the natural gas as associated gas and the liquid as oil.

## How do we account for lags in data reporting?

We include notes in the tables to indicate states that are missing current data because of a lag in annual reporting. For missing years, we repeat a state's latest data. We don't attempt to estimate data that may be missing within a reported year. Appendix A provides a summary table of missing or incomplete state data.

## How long after a well starts producing is it classified into a production-rate bracket?

We include a well in our analysis as soon as data for the first month of production are available in the database.

## Do all wells produce both oil and natural gas?

Most wells produce both oil and natural gas, but some wells produce only one or the other.

## Does the specific reservoir, formation, or play determine the amount of oil and natural gas produced?

Yes. Different zones within the same reservoir (depending on the hydrocarbon content, depth, and burial history) will produce only liquids, a mix of liquids and natural gas, or only natural gas.

## Why do some states have productive drilling sites while others do not?

The best producing areas are often large basins with thick layers of sedimentary rock that accumulated over a long time and that also contain oil and natural gas. States such as North Dakota, Texas, and Pennsylvania have productive drilling sites because they cover large areas of these basins. Subsurface geology and paleogeography are the most important factors in determining whether a state may be an oil and natural gas producer.

## Has the productivity of wells changed since horizontal drilling technology and hydraulic fracturing technology have advanced?

Horizontal drilling and hydraulic fracturing have greatly increased both oil and natural gas production rates of onshore wells in the United States. The decline rates of hydraulically fractured horizontal wells, within shale or tight formations, are typically greater than for wells drilled vertically into conventional reservoirs.

## What is a *stripper well*?

A *stripper well*, also called a *marginal well*, is an oil or natural gas well that is nearing the end of its economically useful life. However, these wells can continue to produce small volumes for long periods.

Many of these wells are still operating, and together they produced approximately 7% of total U.S. oil and natural gas in 2020. The Interstate Oil and Gas Compact Commission defines a stripper well as a well that produces 10 b/d or less of oil or 60,000 cf/d or less of natural gas during a 12-month period. The Internal Revenue Service (IRS)—for tax purposes—defines this type of well as one that produces 15 b/d or less of oil over a calendar year. In addition, 15 b/d or less of oil converts to 90,000 cubic feet or less of natural gas per day over a calendar year. We use the IRS definition.

### **What happens to a well after it stops producing oil or natural gas?**

Operators usually plug and abandon nonproducing wells. However, if they suspect significant amounts of hydrocarbons are still in the reservoir, the well may undergo secondary or tertiary recovery.

### **What is the difference between gross natural gas, wet natural gas, and dry natural gas?**

You can find definitions for [gross natural gas withdrawal](#), [wet natural gas](#), and [dry natural gas](#) in our [glossary](#).

### **Are any wells still drilled using only conventional drilling practices?**

Yes, many vertical wells are still drilled and completed without hydraulic fracturing; however, these wells and older completion techniques are becoming less common. Based on the larger number of wells and footage drilled, horizontal drilling combined with hydraulic fracturing has become standard practice for oil and natural gas production in the United States.

## Suggestions for Querying the Appendix C Excel Data File

Data are provided in a flat-file format for all states for each year from 2000 through 2020 and by well-size class. The *Filter* tool in Excel provides one of the fastest methods for viewing a subset of the data (Figure 5). For example, the filters in Figure 6 are set to select only Alaska (AK) and the year 2020. In Figure 7, the filters are set to select Alaska totals for all years and to sort chronologically.

Figure 5. Example of data provided in flat-file format with filter tool added

State	Year	Production rate bracket	Class num	Oil wells										Natural gas wells										Total wells			
				Number of oil wells	Oil wells: percent of oil wells	Annual oil production (MMbbl)	percent of oil wells	Oil wells: Oil rate per well (bbl)	Oil wells: Annual gas prod. (Ecf)	Oil wells: Gas rate per well (Mcf)	Number of gas wells	Gas wells: percent of gas wells	Annual gas prod. (Ecf)	Gas wells: percent of gas wells	Gas wells: Gas rate per well (Mcf)	Gas wells: Annual oil prod. (MMbbl)	Gas wells: Oil rate per well (bbl)	Total number of wells	Annual oil prod. (MMbbl)	Total gas prod. (Ecf)	Total wells: Horizontal well count						
AK	2000	Z_ Total	23	2033	100	352.579	100	498.373	322.098	455.289	164	100	230.033	100	4123.261	2.57	46.073	2197	355.149	552.131	15						
AK	2000	A_ 0-1	1	12	0.59	0.001	0	0.336	0.001	0.157	10	6.1	0.002	0	0.759	0	0	22	0.001	0.003	0						
AK	2000	B_ 1-2	2	5	0.25	0.003	0	1.391	0.002	0.939	0	0	0	0	0	0	5	0.003	0.002	0							
AK	2000	C_ 2-4	3	9	0.44	0.006	0	2.283	0.011	3.958	3	1.83	0.021	0.01	19.968	0	0	12	0.006	0.032	0						
AK	2000	D_ 4-6	4	10	0.49	0.012	0	3.88	0.021	6.516	2	1.22	0.006	0	23.125	0	0	12	0.013	0.027	0						
AK	2000	E_ 6-8	5	9	0.44	0.011	0	5.763	0.011	5.997	1	0.61	0.015	0.01	41.049	0	0	10	0.011	0.026	0						
AK	2000	F_ 8-10	6	6	0.3	0.018	0	7.995	0.014	6.545	0	0	0	0	0	0	6	0.018	0.014	0							
AK	2000	G_ Subtotal <=10	6.5	51	2.51	0.051	0.01	3.252	0.06	3.812	16	9.76	0.044	0.02	9.497	0	0	67	0.051	0.104	0						
AK	2000	H_ 10-12	7	3	0.15	0.01	0	9.503	0.009	8.15	1	0.61	0.017	0.01	70.611	0	0	4	0.01	0.026	0						
AK	2000	I_ 12-15	8	4	0.2	0.013	0	11.338	0.014	11.813	3	1.83	0.066	0.03	60.034	0.004	3.66	7	0.018	0.08	0						
AK	2000	J_ Subtotal <=15	8.5	58	2.85	0.075	0.02	4.169	0.083	4.607	20	12.2	0.127	0.06	21.215	0.004	0.703	78	0.079	0.21	0						
AK	2000	K_ 15-20	9	15	0.74	0.07	0.02	14.11	0.096	19.368	2	1.22	0.041	0.02	102.816	0	0	17	0.07	0.137	0						
AK	2000	L_ 20-25	10	9	0.44	0.067	0.02	20.511	0.042	12.828	1	0.61	0.044	0.02	120.978	0	0	10	0.067	0.086	0						
AK	2000	M_ 25-30	11	10	0.49	0.084	0.02	22.956	0.102	27.959	1	0.61	0.059	0.03	161.074	0	0	11	0.084	0.161	0						
AK	2000	N_ 30-40	12	14	0.69	0.123	0.03	28.296	0.15	34.668	0	0	0	0	0	0	14	0.123	0.15	0							
AK	2000	O_ 40-50	13	21	1.03	0.292	0.08	38.498	0.309	40.624	5	3.05	0.392	0.17	225.37	0.014	8.044	26	0.306	0.7	0						
AK	2000	P_ 50-100	14	125	6.15	2.778	0.79	65.333	2.424	57.006	20	12.2	2.848	1.24	389.008	0.068	9.325	145	2.846	5.271	0						
AK	2000	Q_ Subtotal <=100	14.5	252	12.4	3.488	0.99	41.385	3.205	38.027	49	29.88	3.511	1.53	216.78	0.086	5.339	301	3.575	6.716	0						
AK	2000	R_ 100-200	15	252	12.4	12.408	3.52	138.848	6.644	74.34	19	11.59	6.203	2.7	916.011	0.054	7.956	271	12.462	12.847	2						
AK	2000	S_ 200-400	16	508	24.99	48.104	13.64	265.301	26.321	145.164	22	13.41	11.994	5.21	1591.823	0.093	12.327	530	48.197	38.315	2						
AK	2000	T_ 400-800	17	541	26.61	95.955	27.22	500.642	76.124	397.172	27	16.46	28.979	12.6	3177.878	0.202	22.104	568	96.157	105.103	5						
AK	2000	U_ 800-1,600	18	353	17.36	115.929	32.88	948.715	127.503	1043.433	25	15.24	58.684	25.51	6944.882	0.329	38.915	378	116.258	186.188	4						
AK	2000	V_ 1,600-3,200	19	110	5.41	58.737	16.66	1717.605	73.647	2153.619	16	9.76	70.269	30.55	12727.585	0.017	3.003	126	58.754	143.916	2						
AK	2000	W_ 3,200-6,400	20	16	0.79	17.714	5.02	4033.25	8.403	1913.302	5	3.05	41.156	17.89	22489.825	0.35	191.142	21	18.064	49.56	0						

Source: U.S. Energy Information Administration

Figure 6. Example of data with filters set to select Alaska (AK) and the year 2020

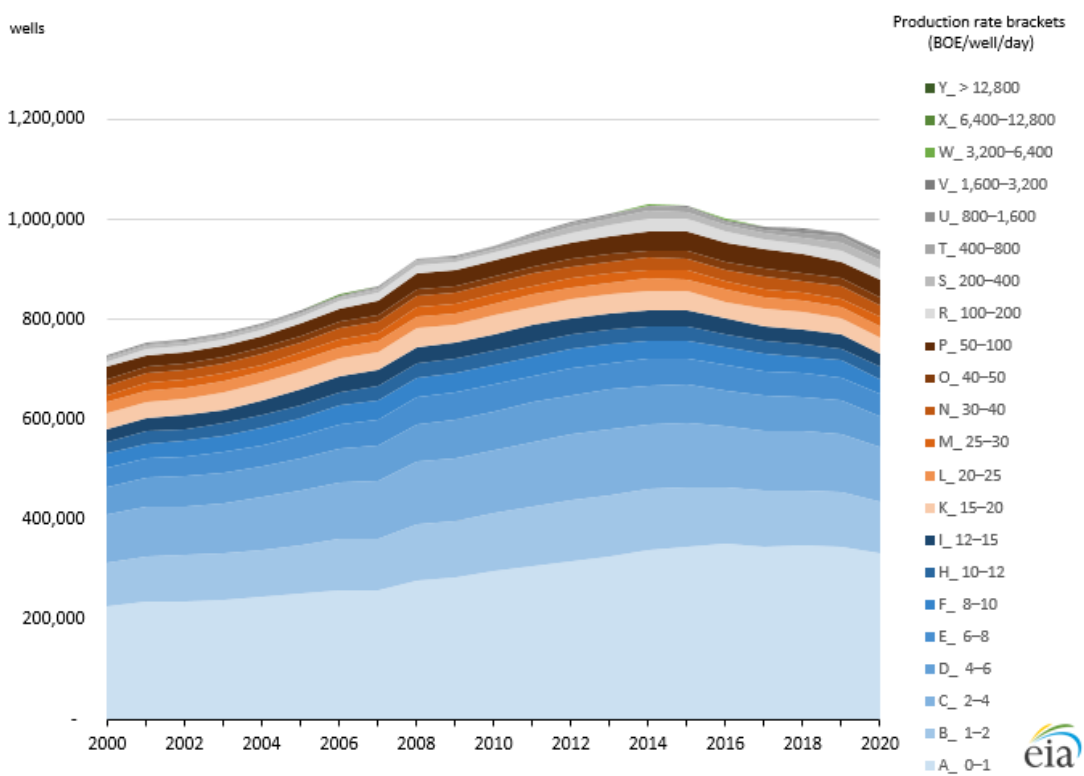
State	Year	Production rate bracket (BOE/d)	Class num	Oil wells	
				Number of oil wells	Oil wells: percent of oil wells
AK	2020	A_ 0-1	1	9	0.68
AK	2020	B_ 1-2	2	3	0.23
AK	2020	C_ 2-4	3	10	0.76
AK	2020	D_ 4-6	4	9	0.68
AK	2020	E_ 6-8	5	4	0.3
AK	2020	F_ 8-10	6	3	0.23
AK	2020	G_ Subtotal <=10	6.5	38	2.89
AK	2020	H_ 10-12	7	10	0.76

Source: U.S. Energy Information Administration

					Oil wells	
State	Year	Production rate bracket (BOE/d)	Class num	Number of oil wells	Oil wells: percent of oil wells	
AK	2000	Z_Total	23	2033	100	
AK	2001	Z_Total	23	2116	100	
AK	2002	Z_Total	23	2136	100	
AK	2003	Z_Total	23	2128	100	
AK	2004	Z_Total	23	2108	100	
AK	2005	Z_Total	23	2110	100	
AK	2006	Z_Total	23	2056	100	
AK	2007	Z_Total	23	2025	100	
AK	2008	Z_Total	23	2067	100	
AK	2009	Z_Total	23	2082	100	
AK	2010	Z_Total	23	2054	100	

[illegible]

Figure 9. Example of a chart made with a pivot table



## Appendix A

Appendix A contains information about data availability.

Reporting status by state and year .....	A1
Availability of completion, well, and lease data by state .....	A2

## Appendix B

Appendix B contains oil and natural gas well summary statistics.

U.S. oil and natural gas well summary statistics for years 2000–2020.....	B1
Most recent year of available data for each state and federal offshore regions .....	B21

## Appendix C

Appendix C is a separate Excel flat file with all data.